

What is claimed is:

1. A real image mode finder optical system constructed to be independent of a photographing optical system, comprising, in order from an object side:

an objective optical system with a positive refracting power;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes image erecting means, and a focal length of said objective optical system can be made shorter than a focal length of said eyepiece optical system, said real image mode finder optical system satisfying the following condition:

$$0.52 < mh / fe < 1$$

where mh is a maximum width of said field frame and fe is a focal length of said eyepiece optical system.

2. A real image mode finder optical system comprising, in order from an object side:

an objective optical system with a positive refracting power;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes image erecting means, and said objective optical system includes three of reflecting surfaces of said image erecting means and said eyepiece optical system includes one of reflecting surfaces of said image erecting means so that an image is erected through four reflecting surfaces comprised of three reflecting surfaces of said objective optical system and one re-

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flecting surface of said eyepiece optical system, and

wherein a focal length of said objective optical system is variable, and when a magnification of said finder optical system is changed, at least two lens units are moved along different paths and a focal length of said objective optical system at a wide-angle position thereof is shorter than a focal length of said eyepiece optical system, said real image mode finder optical system satisfying the following condition:

$$0.52 < mh / fe < 1$$

where mh is a maximum width of said field frame and fe is a focal length of said eyepiece optical system.

3. A real image mode finder optical system comprising, in order from an object side:

an objective optical system with a positive refracting power;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes image erecting means, and said objective optical system includes three of reflecting surfaces of said image erecting means and said eyepiece optical system includes one of reflecting surfaces of said image erecting means so that an image is erected through four reflecting surfaces comprised of three reflecting surfaces of said objective optical system and one reflecting surface of said eyepiece optical system,

wherein a focal length of said objective optical system is variable, and when a magnification of said finder optical system is changed, at least two lens units are moved along different paths and a focal length of said objective optical system at a wide-angle position thereof is shorter than a focal length of said eyepiece optical system.

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wherein said image erecting means including said three reflecting surfaces of said objective optical system is constructed with two prisms so that each of said prisms has at least one reflecting surface and one of an entrance surface and an exit surface of each prism is configured as a curved surface with finite curvature.

4. A real image mode finder optical system comprising, in order from an object side:

an objective optical system with a positive refracting power;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said objective optical system has image erecting means including four reflecting surfaces, and

wherein a focal length of said objective optical system is variable, and when a magnification of said finder optical system is changed, at least two lens units are moved along different paths and a focal length of said objective optical system at a wide-angle position thereof is shorter than a focal length of said eyepiece optical system, said real image mode finder optical system satisfying the following condition:

$$0.52 < mh / fe < 1$$

where mh is a maximum width of said field frame and fe is a focal length of said eyepiece optical system.

5. A real image mode finder optical system comprising, in order from an object side:

an objective optical system with a positive refracting power;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said objective optical system has image erecting means including four reflecting surfaces, and

wherein a focal length of said objective optical system is variable, and when a magnification of said finder optical system is changed, at least two lens units are moved along different paths and a focal length of said objective optical system at a wide-angle position thereof is shorter than a focal length of said eyepiece optical system.

6. A real image mode finder optical system according to claim 1, wherein a focal length of said objective optical system is variable, and when a magnification of said finder optical system is changed, at least two lens units are moved along different paths.

7. A real image mode finder optical system according to claim 1, satisfying the following condition:

$$12.0 \text{ mm} < f_e < 18.0 \text{ mm}$$

8. A real image mode finder optical system according to claim 1, satisfying the following condition:

$$13.5 \text{ mm} < f_e < 16.5 \text{ mm}$$

9. A real image mode finder optical system according to claim 1, wherein said objective optical system includes three of reflecting surfaces of said image erecting

means and said eyepiece optical system includes one of reflecting surfaces of said image erecting means so that an image is erected through four reflecting surfaces comprised of three reflecting surfaces of said objective optical system and one reflecting surface of said eyepiece optical system.

10. A real image mode finder optical system according to claim 1, wherein said objective optical system has said image erecting means including four reflecting surfaces so that an image is erected through said four reflecting surfaces of said objective optical system.

11. A real image mode finder optical system according to claim 2, wherein said objective optical system comprises, in order from said object side, a first unit with a negative power, fixed or moved when said magnification is changed; a second unit with a positive power, moved when said magnification is changed; a third unit with a negative power, moved when said magnification is changed; and a fourth unit with a positive power, fixed when said magnification is change and including three reflecting surfaces.

12. A real image mode finder optical system according to claim 11, wherein said fourth unit includes at least one prism having at least one reflecting surface, and one of an entrance surface and an exit surface of said prism is configured as a curved surface with finite curvature.

13. A real image mode finder optical system according to claim 11, wherein each of said first unit, said second unit, and said third unit is constructed with a single lens.

14. A real image mode finder optical system according to claim 11, wherein said eyepiece optical system includes two optical elements having lens functions, providing air spacing between said two optical elements and has a positive refracting power as a whole.

15. A real image mode finder optical system according to claim 14, wherein said eyepiece optical system includes, in order from said object side, a prism which provides an exit surface thereof with a lens function and has a part of an image erecting function and a single positive lens component.

16. A real image mode finder optical system according to claim 15, wherein said prism of said eyepiece optical system has a lens function with respect to an entrance surface thereof.

17. A real image mode finder optical system according to claim 15, wherein said positive lens component of said eyepiece optical system is constructed so that diopter adjustment can be made in accordance with an observer's diopter.

18. A real image mode finder optical system according to claim 2, satisfying the following condition:

$$12.0 \text{ mm} < f_e < 18.0 \text{ mm}$$

19. A real image mode finder optical system according to claim 4, wherein said objective optical system includes, in order from said object side, a first unit with a negative power, moved when said magnification is changed; a second unit with a positive power, moved when said magnification is changed; a third unit with a negative power,

5 moved when said magnification is changed; and a fourth unit with a positive power, fixed when said magnification is change and including three reflecting surfaces.

20. A real image mode finder optical system according to claim 19, wherein said fourth unit includes two prisms so that each of said prisms has at least one reflecting surface and one of an entrance surface and an exit surface of each prism is configured as a curved surface with finite curvature.

21. A real image mode finder optical system according to claim 20, wherein at least one of said two prisms has totally reflecting surfaces.

22. A real image mode finder optical system according to claim 20, wherein each of said first unit, said second unit, and said third unit is constructed with a single lens.

23. A photographing apparatus provided with a real image mode finder optical system comprising, in order from an object side:

an objective optical system with a positive refracting power;  
a field frame located in the proximity of an imaging position of said objective optical system; and

5 an eyepiece optical system with a positive refracting power,  
wherein said real image mode finder optical system includes image erecting means, and a focal length of said objective optical system can be made shorter than a focal length of said eyepiece optical system, said real image mode finder optical system satisfying the following condition:

$$0.52 < m_h / f_e < 1$$

10 where  $m_h$  is a maximum width of said field frame and  $f_e$  is a focal length of said eye-

piece optical system.

24. A real image mode finder optical system constructed to be independent of a photographing optical system, comprising, in order from an object side:

an objective optical system with a positive refracting power;  
a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,  
wherein said real image mode finder optical system includes an image erecting means and

wherein said objective optical system is capable of having a focal length shorter than a focal length of said eyepiece optical system, and said eyepiece optical system has at least one lens element so that a most observer's pupil-side lens element satisfies the following condition:

$$v > 70$$

where  $v$  is an Abbe's number of said most observer's pupil-side lens element.

25. A real image mode finder optical system constructed to be independent of a photographing optical system, comprising, in order from an object side:

an objective optical system with a positive refracting power;  
a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,  
wherein said real image mode finder optical system includes an image erecting means and

wherein said objective optical system is capable of having a focal length shorter



10 than a focal length of said eyepiece optical system, and said eyepiece optical system has at least one lens element to satisfy the following conditions:

$$0.52 < mh / fe < 1$$

$$v > 70$$

15 where mh is a maximum width of said field frame, fe is a focal length of said eyepiece optical system, and v is an Abbe's number of a most observer's pupil-side lens element.

26. A real image mode finder optical system constructed to be independent of a photographing optical system, comprising, in order from an object side:

an objective optical system with a positive refracting power;

5 a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes an image erecting means and

10 wherein said objective optical system is capable of having a focal length shorter than a focal length of said eyepiece optical system, and said eyepiece optical system has a cemented lens component including a positive lens element and a negative lens element at a most observer's pupil-side position.

27. A real image mode finder optical system according to claim 25, wherein said focal length of said objective optical system is variable, and when a magnification of said finder optical system is changed, at least two lens units are moved along different paths.

28. A real image mode finder optical system according to claim 25, wherein said objective optical system includes three of reflecting surfaces of said image erecting means and said eyepiece optical system includes one of reflecting surfaces of said image erecting means so that an image is erected through four reflecting surfaces comprised of three reflecting surfaces of said objective optical system and one reflecting surface of said eyepiece optical system.

29. A real image mode finder optical system according to claim 25, wherein said objective optical system has said image erecting means including four reflecting surfaces so that an image is erected through said four reflecting surfaces of said objective optical system.

30. A real image mode finder optical system constructed to be independent of a photographing optical system, comprising, in order from an object side:

an objective optical system with a positive refracting power;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes an image erecting means and

wherein said objective optical system is capable of having a focal length shorter than a focal length of said eyepiece optical system, and said eyepiece optical system has a cemented lens component including a positive lens element and a negative lens element at a most observer's pupil-side position to satisfy the following condition:

$$0.52 < mh / fe < 1$$

where mh is a maximum width of said field frame and fe is a focal length of said eye-

15 piece optical system.

31. A real image mode finder optical system according to claim 30, wherein said focal length of said objective optical system is variable, and when a magnification of said finder optical system is changed, at least two lens units are moved along different paths.

32. A real image mode finder optical system according to claim 30, wherein said objective optical system has said image erecting means including four reflecting surfaces so that an image is erected through said four reflecting surfaces of said objective optical system.

33. A photographing apparatus provided with a real image mode finder optical system constructed to be independent of a photographing optical system, comprising, in order from an object side:

an objective optical system with a positive refracting power;

5 a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes an image erecting means and

10 wherein said objective optical system is capable of having a focal length shorter than a focal length of said eyepiece optical system, and said eyepiece optical system has at least one lens element so that a most observer's pupil-side lens element satisfies the following condition:

$$v > 70$$

15 where  $v$  is an Abbe's number of said most observer's pupil-side lens element.

34. A real image mode finder optical system comprising, in order from an object side;

an objective optical system with a positive refracting power;

5 a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes image erecting means, and

10 wherein said objective optical system includes, in order from said object side, a first unit with a negative refracting power, a second unit with a positive refracting power, a third unit with a negative refracting power, and a fourth unit with a positive refracting power so that a magnification of said finder optical system is changed, ranging from a wide-angle position to a telephoto position, by simply moving said second unit toward said object side and said third unit toward said eyepiece optical system to satisfy the following condition:

$$12.0 \text{ mm} < f_e < 18.0 \text{ mm}$$

15 where  $f_e$  is a focal length of said eyepiece optical system.

35. A real image mode finder optical system comprising, in order from an object side;

an objective optical system with a positive refracting power;

5 a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes image erecting means,  
and

wherein said objective optical system includes, in order from said object side, a  
10 first unit with a negative refracting power, a second unit with a positive refracting  
power, a third unit with a negative refracting power, and a fourth unit with a positive  
refracting power so that a magnification of said finder optical system is changed,  
ranging from a wide-angle position to a telephoto position, by simply moving said  
second unit toward said object side and said third unit toward said eyepiece optical  
15 system to satisfy the following condition:

$$0.52 < mh / fe < 1$$

where mh is a maximum width of said field frame and fe is a focal length of said eye-  
piece optical system.

36. A real image mode finder optical system comprising, in order from an object  
side;

an objective optical system with a positive refracting power;

a field frame located in the proximity of an imaging position of said objective opti-  
5 cal system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes image erecting means,  
and

wherein said objective optical system is capable of having a focal length shorter  
10 than a focal length of said eyepiece optical system, and said eyepiece optical system  
includes, in order from said object side, a prism unit with a positive refracting power  
and a lens unit with a positive refracting power so that a most field-frame-side surface  
of said prism unit with a positive refracting power has a positive refracting power and

is configured as an aspherical surface with a negative refracting power on a periphery thereof.

37. A real image mode finder optical system according to claim 35, wherein said eyepiece optical system, in order from said object side, a prism unit with a positive refracting power and a lens unit with a positive refracting power so that a most field-frame-side surface of said prism unit with a positive refracting power has a positive refracting power on an optical axis thereof and is configured as an aspherical surface with a negative refracting power on a periphery thereof.

38. A real image mode finder optical system according to claim 36, wherein said objective optical system has at least two lens units, said focal length of said objective optical system is variable, and when said magnification is changed, at least two lens units are moved along different paths.

39. A photographing apparatus provided with a real image mode finder optical system comprising, in order from an object side:

an objective optical system with a positive refracting power;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system includes image erecting means, and

wherein said objective optical system includes, in order from said object side, a first unit with a negative refracting power, a second unit with a positive refracting power, a third unit with a negative refracting power, and a fourth unit with a positive

refracting power so that a magnification of said finder optical system is changed, ranging from a wide-angle position to a telephoto position, by simply moving said second unit toward said object side and said third unit toward said eyepiece optical system to satisfy the following condition:

$$12.0 \text{ mm} < f_e < 18.0 \text{ mm}$$

where  $f_e$  is a focal length of said eyepiece optical system.

40. A real image mode finder optical system comprising, in order from an object side:

an objective optical system which has a positive refracting power and changes a magnification of said finder optical system;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system has image erecting means, and

wherein said objective optical system includes, in order from said object side, a front unit with a negative refracting power and a rear unit with a positive refracting power,

said front unit being constructed with a plurality of lens units so that a magnification of said finder optical system is changed, ranging from a wide-angle position to a telephoto position, by moving at least two of said plurality of lens units and

said rear unit being constructed with a plurality of prism units with positive refracting powers so that at least one of surfaces opposite to one another, of said plurality of prism units is configured to be convex.

41. A real image mode finder optical system comprising, in order from an object

side:

an objective optical system which has a positive refracting power and changes a magnification of said finder optical system;

5 a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system has image erecting means, and

10 wherein said objective optical system includes, in order from said object side, a first unit with a negative refracting power, a second unit with a positive refracting power, a third unit with a negative refracting power, and a fourth unit with a positive refracting power,

said fourth unit being comprised of a fourth front sub-unit and a fourth rear sub-unit,

15 a magnification of said finder optical system being changed, ranging from a wide-angle position to a telephoto position, by moving said second unit and said third unit,

each of said first unit, said second unit, and said third unit being constructed with a lens, and

20 each of said fourth front sub-unit and said fourth rear sub-unit being constructed with a prism so that at least one of surfaces opposite to each other, of said fourth front sub-unit and said fourth rear sub-unit is configured to be convex.

42. A real image mode finder optical system according to claim 58, wherein said fourth front sub-unit includes a single prism and has one reflecting surface.

43. A real image mode finder optical system according to claim 41, satisfying the following condition:



$$-1.0 < MG45 < -0.5$$

where MG45 is a combined imaging magnification of said fourth front sub-unit and said fourth rear sub-unit at an object distance of 3 m.

44. A real image mode finder optical system according to claim 41, wherein each of said second unit and said third unit is constructed with a single lens and satisfies the following condition:

$$-1.9 < f2 / f3 < -1.0$$

where f2 is a focal length of said second unit and f3 is a focal length of said third unit.

45. A real image mode finder optical system according to any one of claim 41, satisfying the following condition:

$$2.7 < mT / mW < 7.0$$

where mW is a finder magnification of an entire system at said wide-angle position and mT is a finder magnification of an entire system at said telephoto position.

46. A photographing apparatus provided with a real image mode finder optical system comprising, in order from an object side:

an objective optical system which has a positive refracting power and changes a magnification of said finder optical system;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system has image erecting means, and

wherein said objective optical system includes, in order from said object side, a front unit with a negative refracting power and a rear unit with a positive refracting

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power, said front unit being constructed with a plurality of lens units so that a magnification of said finder optical system is changed, ranging from a wide-angle position to a telephoto position, by moving at least two of said plurality of lens units and said rear unit being constructed with a plurality of prism units with positive refracting powers so that at least one of surfaces opposite to one another, of said plurality of prism units is configured to be convex.

47. A real image mode finder optical system comprising, in order from an object side:

an objective optical system which has a positive refracting power and changes a magnification of said finder optical system;

a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system has image erecting means,

wherein said objective optical system includes, in order from said object side, a first unit with a negative refracting power, a second unit with a positive refracting power, a third unit with a negative refracting power, and a fourth unit with a positive refracting power so that a magnification of said finder optical system is changed, ranging from a wide-angle position to a telephoto position, by simply moving said second unit toward said object side and said third unit toward an eyepiece side, and

wherein a combined focal length of said first unit, said second unit, and said third unit is negative, and when said magnification is changed over a range from said wide-angle position to said telephoto position, a combined imaging magnification of said second unit and said third unit is  $1\times$ .

48. A real image mode finder optical system according to claim 47, satisfying the following condition:

$$-1.2 < \beta_3 < -0.8$$

where  $\beta_3$  is an imaging magnification of said third unit in a state where an imaging magnification of said second unit is  $-1\times$  at an object distance of 3 m when said magnification is changed in a range from said wide-angle position to said telephoto position.

49. A real image mode finder optical system according to claim 47, wherein said second unit is constructed with a single lens and satisfies the following condition:

$$-0.6 < SF2 < 0.6$$

where  $SF2 = (r_3 + r_4) / (r_3 - r_4)$ , which is a shape factor of said second unit,  $r_3$  is a radius of curvature of an object-side surface of said second unit, and  $r_4$  is a radius of curvature of an eyepiece-side surface of said second unit.

50. A real image mode finder optical system according to claim 47, wherein each of said second unit and said third unit is constructed with a single lens and satisfies the following condition:

$$-1.9 < f_2 / f_3 < -1.0$$

where  $f_2$  is a focal length of said second unit and  $f_3$  is a focal length of said third unit.

51. A real image mode finder optical system according to claim 47, wherein said fourth unit is fixed when said magnification is changed in a range from said wide-angle position to said telephoto position.

52. A real image mode finder optical system according to claim 47, wherein said

fourth unit includes two optical units with positive refracting powers.

53. A real image mode finder optical system according to claim 47, wherein said fourth unit has a plurality of reflecting surfaces.

54. A real image mode finder optical system according to claim 47, wherein said first unit is also moved when said magnification is changed in a range from said wide-angle position to said telephoto position.

55. A real image mode finder optical system according to claim 47, wherein said first unit is fixed when said magnification is changed in a range from said wide-angle position to said telephoto position.

56. A photographing apparatus provided with a real image mode finder optical system comprising, in order from an object side:

an objective optical system which has a positive refracting power and changes a magnification of said finder optical system;

5 a field frame located in the proximity of an imaging position of said objective optical system; and

an eyepiece optical system with a positive refracting power,

wherein said real image mode finder optical system has image erecting means,

10 wherein said objective optical system includes, in order from said object side, a first unit with a negative refracting power, a second unit with a positive refracting power, a third unit with a negative refracting power, and a fourth unit with a positive refracting power so that a magnification of said finder optical system is changed, ranging from a wide-angle position to a telephoto position, by simply moving said

second unit toward said object side and said third unit toward an eyepiece side, and

- 15        wherein a combined focal length of said first unit, said second unit, and said third unit is negative, and when said magnification is changed over a range from said wide-angle position to said telephoto position, a combined imaging magnification of said second unit and said third unit is  $1\times$ .